

Dissolved Oxygen Monitoring in the Puyallup River at Sumner July-October 2003

Quality Assurance Project Plan
Gregory S. Zentner
Ecology SWRO

Project Description

The Washington State Department of Ecology (Ecology) is monitoring the Puyallup River at Sumner to assess late summer and early fall dissolved oxygen levels. Monitoring by the United States Geological Survey, Ecology and the Puyallup Tribe of Indians in 2000 and 2001 showed that the lower Puyallup River meets the state dissolved oxygen standard by only a small amount. 2001 and 2002 monitoring showed that the White River may not always meet standards. No similar data exist for the upper Puyallup. Ecology prepared this Quality Assurance Project Plan to guide this year's data collection effort.^{1 2}

Ecology's monitoring is an outgrowth of Total Maximum Daily Load (TMDL) studies and an agreement reached with stakeholders. Ecology established annual and seasonal total maximum daily loads for 5-day biochemical oxygen demand (BOD₅) and ammonia (NH₃) in 1993 and 1994. In 1996, EPA, the Puyallup Tribe of Indians and Ecology initiated a mediation process to allocate the reserve capacity identified in the TMDL. The resulting 1998 agreement included a provision for monitoring dissolved oxygen and related parameters.

Ecology and the Puyallup Tribe began monitoring under the TMDL agreement in 2000 when they established two stations in the lower Puyallup River. The data suggested that the river was not meeting the dissolved oxygen standard and Ecology issued a moratorium on allocating the reserve. In 2001, the United States Geological Survey, in partnership with Ecology and the Puyallup Tribe, monitored water quality in the Puyallup and White Rivers. That data and 2002 data from the White River showed that some of the year 2000 data was inaccurate, a result of probe fouling with sediment, but that the White River at times either violated standards or was meeting standards by only a small amount. As a result, Ecology has kept the moratorium in place.

¹ Ecology staff prepared this QAPP using the 2002 White River QAPP, prepared by the USGS, as a template.

² In this QAPP, the lower Puyallup River is the Puyallup River below the confluence with the White River. The upper Puyallup River is the Puyallup River above the confluence with the White River

Project Goals

The goals of this study are:

1. Produce verified records of dissolved-oxygen concentration and temperature measured at 30-minute intervals on the upper Puyallup River at Sumner from late-July 2003 until late-October 2003; and
2. Evaluate the use of a Solinst Inc. dissolved oxygen / temperature probe over multi-week deployments.³

Project Objectives

The objectives of this study are

1. Define the variability of dissolved oxygen and temperature in the upper Puyallup River; and
2. Deploy the probe over four representative 2-week periods during the 3-month project. At all other times during the 3-months, Ecology will deploy the probe for 1-week periods.

Study Design

Ecology's Water Quality Program (Southwest Regional Office) and Environmental Assessment Programs are responsible for designing and carrying out on this study, in consultation with Puyallup Tribe of Indians. William Ward of EAP and Gregory Zentner of the WQP-SWRO are the responsible Ecology staff. Char Naylor is the contact for the Puyallup Tribe of Indians.

Continuous Monitoring and Quality Control

Ecology installed a Solinst Inc. Model 3001 Dissolved Oxygen Levellogger at RM 0.03 of the Upper Puyallup River on July 25, 2003. The sampling location is off the peninsula of land between the White and Puyallup Rivers immediately west of the Sumner Wastewater Treatment Plant. Ecology deployed the probe in an anchored, locked housing extending from the shore into the river, with the probe situated roughly one foot off of the bed. The probe will be in place until late-October and will record dissolved-oxygen concentration and temperature at 30-minute intervals.

Ecology will inspect the probe and download data every seven days while in operation, except for four periods of 2-week deployment.

Each time Ecology staff service the probe, staff will:

- photograph the sampling station and river for water level;
- inspect the probes for sediment build-up in the housing;
- measure air and water temperature (pre-data download),

³ In 2000, 2001 and 2002, USGS, Ecology, and the Puyallup Tribe used a Hydrolab Datasond™ 4 and 4a water quality monitors that record D.O., temperature, specific conductance, and pH. In 2003, Ecology is using a Solinst Model 3001 Dissolved Oxygen Levellogger to record dissolved oxygen and temperature.

- obtain samples for Winkler D.O. analysis;
- download data and re-deploy the probe;
- measure air and water temperature (post-data download),
- obtain samples for Winkler D.O. analysis.

Ecology staff expect there will be 30-60 minutes between the two sampling times for Winkler D.O. analysis.

Staff will store samples in a covered container or on ice in a cooler, transport the samples to the Environmental Assessment Programs Operations Center, and analyze samples for dissolved oxygen using the EAP D.O. analysis station. Staff will follow Standard Methods 4500-0 C. Oxygen (Dissolved) Azide Modification with the following clarifications to the method:

- Add 2 ml of MnSO_4 solution in the field immediately after sampling.
- Add 2 ml of alkali-iodide-azide reagent in the field immediately after sampling.
- Add 2 ml conc. H_2SO_4 after transport in the lab.⁴

Staff will review the attached equipment and pre-sampling checklist prior to leaving the office.

Ecology will inspect the downloaded data weekly (or bi-weekly for 2-week deployments) and compare probe data with QC data. Field staff will alert responsible Ecology and Tribal staff if probe data is not within data quality objectives. As part of the data inspection process, Ecology will download and review provisional USGS river flow data for the Puyallup River at Alderton gauging station.

Ecology will return the probes annually to the manufacturer for calibration. The probes do not require field calibration.

Data Analysis and Reporting

Ecology will make continuous monitoring data and a short summary report available on its Web site. If the probe data is biased relative to the Winkler analysis, Ecology will correct the data.

Data Quality Objectives

Ecology's objectives for data quality are to have a difference

- not greater than 0.2 mg/L or 0.2 °C between QC and probe D.O. data on any QC sampling occasion, consistent with the manufacturer's accuracy specification; or

⁴ Samples need to be stored at 10-20 °C; ice will not be necessary on cool days.

- not greater than 0.5 mg/L or 0.5 °C C between data set pairs provided one data set (e.g. probe data) is consistently higher or lower than the other data set (e.g. QC data).⁵

Ecology will inspect the downloaded data weekly to assess data quality.

Ecology staff will review field and laboratory procedures monthly to confirm that the sampling and analysis is being conducted per Standard Methods.

Timelines and Products

Monitoring and profiling will be completed by October 31, 2003. Ecology will complete a draft summary report by November 30, 2003. Ecology will make the final report and data available in January 2004.

References

Ebbert, James. 2002. Concentrations of Dissolved Oxygen in the Lower Puyallup and White Rivers, Washington, August and September 2000 and 2001. US Geological Survey Water-Resources Investigations Report 02-4146.

⁵ In their 2002 report (Ebert, 2002) on 2000 & 2001 sampling on the Lower Puyallup and White, the USGS rates data in the following matter:

Excellent: Correction less than or equal to +/- 0.3 mg/L
Good: Correction less than +/- 0.3 to 0.5 mg/L
Fair: Correction less than +/- 0.5 to 0.8 mg/L
Poor: Correction greater than +/- 0.8 mg/L.

Checklist for Solinst Monitoring

1. Access to O.C. Building & Lab
2. D.O. Tray with
D.O. Bottles w/ stoppers, lids
Pipettes
Reagents (2)
Sample tube
Thermometer
Ties
USGS key
3. Sample cooler
Ice
4. Portable Computer #2
Communication cable for data download
 - Check the battery level
 - Check the time on the computer clock
5. Clipboard
Data sheets
Pencil
6. Tools
Wrenches: 7/16" wrench and 7/16" socket
Knife
Needle nose pliers (small)
Watch
Wd-40
7. Hat, Knee-or Hip-Boots, Drinking Water, Snack
8. Camera with disc